



2.1 Linear Functions & Graphs

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2.1.1 Equations of a Straight Line

Equations of a Straight Line

How do I find the gradient of a straight line?

- Find two points that the line passes through with coordinates (x_1, y_1) and (x_2, y_2)
- The gradient between these two points is calculated by

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

- This is given in the formula booklet
- The gradient of a straight line measures its **slope**
 - A line with gradient 1 will go up 1 unit for every unit it goes to the right
 - A line with gradient -2 will go down two units for every unit it goes to the right

What are the equations of a straight line?

- y = mx + c
 - This is the gradient-intercept form
 - It clearly shows the gradient *m* and the *y*-intercept (0, c)
- $y y_1 = m(x x_1)$
 - This is the **point-gradient form**
 - It clearly shows the gradient m and a point on the line (x_1, y_1)
- ax + by + d = 0
 - This is the **general form**

• You can quickly get the *x*-intercept
$$\left(-\frac{d}{a}, 0\right)$$
 and *y*-intercept $\left(0, -\frac{d}{b}\right)$

How do I find an equation of a straight line?

- You will need the gradient
 - If you are given two points then first find the gradient
- It is easiest to start with the point-gradient form
 - then rearrange into whatever form is required
 - multiplying both sides by any denominators will get rid of fractions
- You can check your answer by using your GDC
 - Graph your answer and check it goes through the point(s)
 - If you have two points then you can enter these in the statistics mode and find the regression line
 - y = ax + b

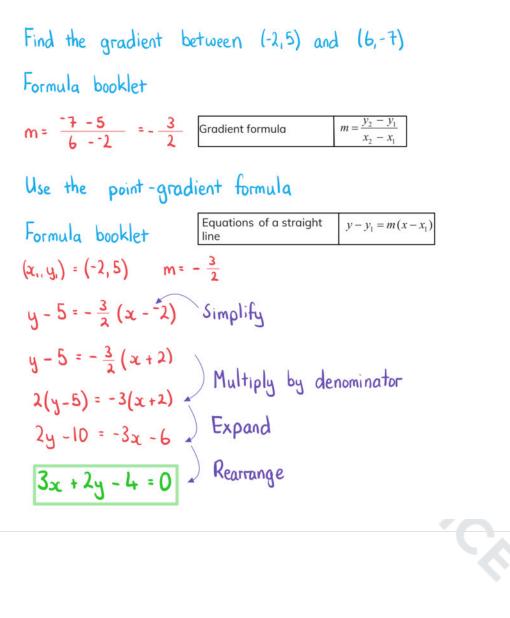
S.C.



Worked example

The line I passes through the points (-2, 5) and (6, -7).

Find the equation of 1, giving your answer in the form ax + by + d = 0 where a, b and d are integers to be found.





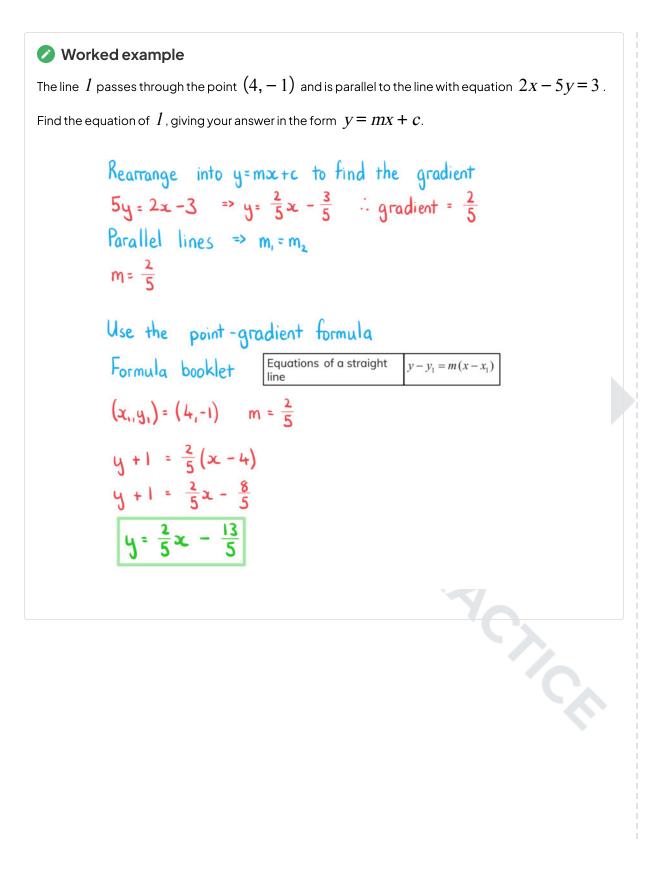
Parallel Lines

How are the equations of parallel lines connected?

- Parallel lines are always equidistant meaning they never intersect
- Parallel lines have the same gradient
 - If the gradient of line l_1 is m_1 and gradient of line l_2 is m_2 then...
 - $m_1 = m_2 \Rightarrow l_1 \& l_2$ are parallel
 - $l_1 \& l_2$ are parallel $\Rightarrow m_1 = m_2$
- To determine if two lines are parallel:
 - Rearrange into the gradient-intercept form y = mx + c
 - Compare the coefficients of X
 - If they are equal then the lines are parallel









Perpendicular Lines

How are the equations of perpendicular lines connected?

- Perpendicular lines intersect at right angles
- The gradients of two perpendicular lines are negative reciprocals
 - If the gradient of line l_1 is m_1 and gradient of line l_2 is m_2 then...
 - $m_1 \times m_2 = -1 \Rightarrow l_1 \& l_2$ are perpendicular
 - $l_1 \& l_2$ are perpendicular $\Rightarrow m_1 \times m_2 = -1$
- To determine if two lines are perpendicular:
 - Rearrange into the gradient-intercept form y = mx + c
 - Compare the coefficients of X
 - If their product is -1 then they are perpendicular
- Be careful with horizontal and vertical lines
 - x = p and y = q are perpendicular where p and q are constants





Worked example

The line I_1 is given by the equation 3x - 5y = 7.

The line I_2 is given by the equation $y = \frac{1}{4} - \frac{5}{3}x$.

Determine whether I_1 and I_2 are perpendicular. Give a reason for your answer.

Rearrange L, into y = mx + c form $5y = 3x - 7 = y = \frac{3}{5}x - \frac{7}{5}$ Identity gradients $m_1 = \frac{3}{5}$ $m_2 = -\frac{5}{3}$ $m_1 \times m_2 = -1 = Perpendicular lines$ $\frac{3}{5} \times -\frac{5}{3} = -1$

L, and L₂ are perpendicular as m₁xm₂=-1